Toddlers' Processing of Child-Produced Speech in Silence and Background Noise

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Introduction

Research to date has explored toddlers' speech perception in overly simplistic contexts, such as using primarily speech from female adults, and primarily in silence.

In the real world children:
- hear speech from many speakers, including other children [1]
- hear speech in noisy environments, e.g. with background noise, music, and speech [2].

Previous research finds that:
- toddlers find it harder to process speech from same-aged peers [3]
- background noise can make speech recognition more challenging [4, 5].

We do not yet know how toddlers process speech from children and adults in noisy environments that resemble their real experiences. Here we ask:
RQ1. How do toddlers process child-produced vs. adult-produced speech?
RQ2. How does real-world background noise impact toddlers' processing?

Current Study

Method:

Two picture Visual World eye-tracking paradigm (see Figure 1)

Participants: 30-to-36-month-old toddlers
- n = 19 (Condition 1 = 8, Condition 2 = 11)
- Data collection in progress, target sample = 60 (30 in each condition)

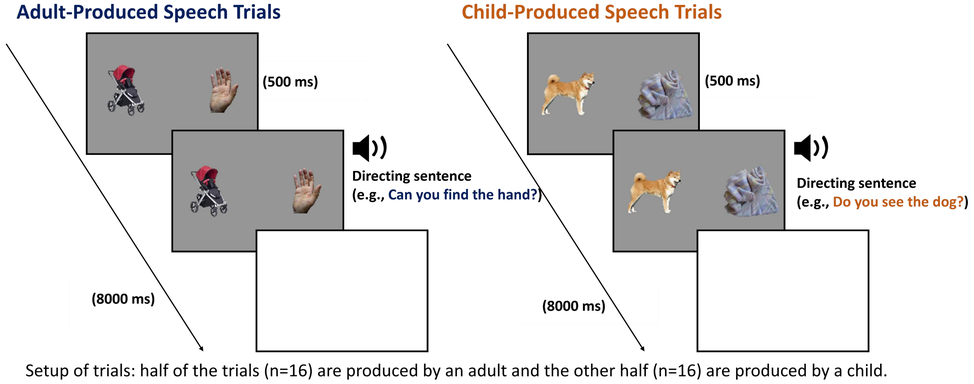
Background Noise Conditions (between subjects)
- No background noise (silence)
- Real-world background noise (from LENA recordings: noise from children's homes; 10 db SNR)

Stimuli (within subjects)
Sentences recorded from two parent-child pairs
- Child speaker (n=16 trials)
- Adult speaker (n= 16 trials)

Analysis:
- Overall looking time analysis and Growth curve modeling analysis
- To account for baseline preferences, we subtracted the baseline proportion of target looking [-2000 to -1500 from target word onset] from the proportion during the analysis window [367 to 2367 from target word onset]
  CorrectedTargetLooking = TargetLooking – BaselineLooking

Procedure

Figure 1. Schematic of Experiment.

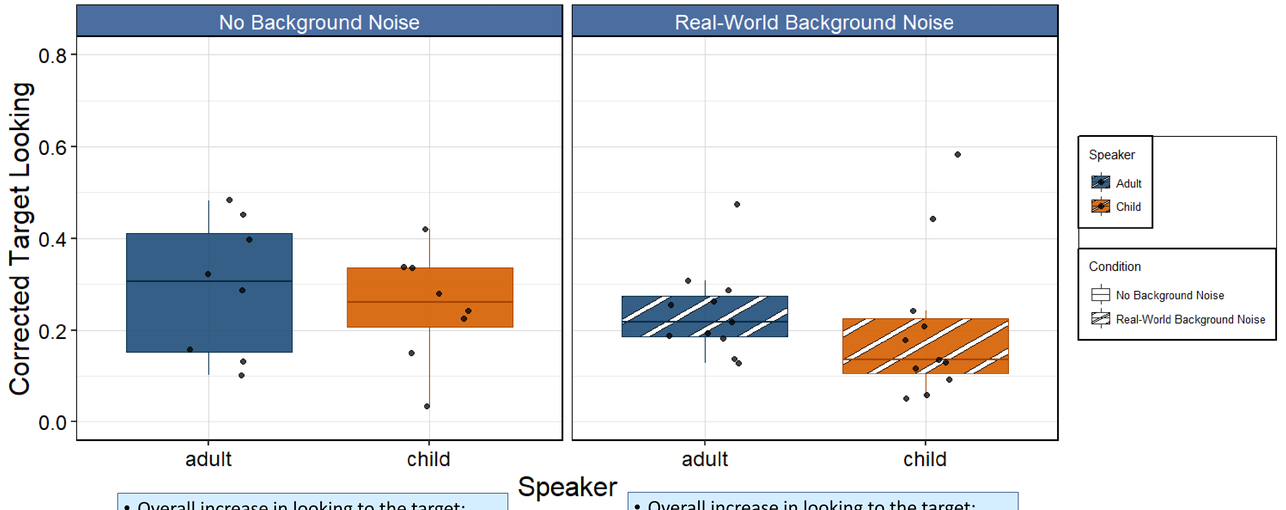


Setup of trials: half of the trials (n=16) are produced by an adult and the other half (n=16) are produced by a child.

Results

Overall Looking Time Analysis:

Figure 2. The corrected proportion of looking to the target by speaker-age, in silence (left) and in real-world background noise (right).



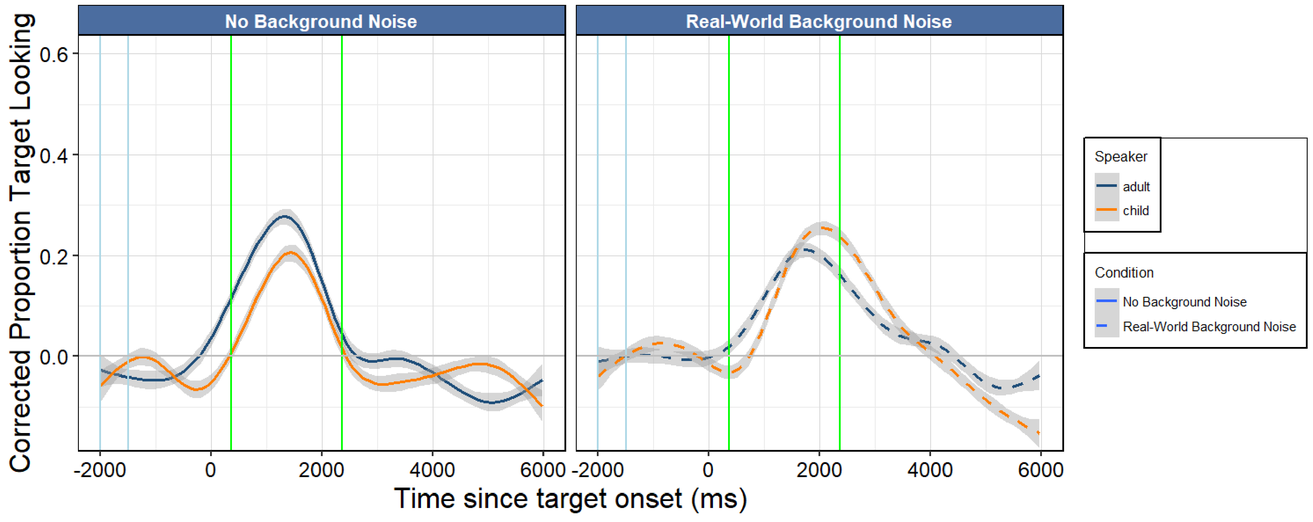
- Overall increase in looking to the target: Adult speech: 29 % ; Child speech: 25 %
- Overall increase in looking to the target: Adult speech: 23 % ; Child speech: 20 %

Participants increase looking to the target more than chance (p <.001), no effect of background noise (p= 0.28), no effect in speaker-age (p= 0.39), no interaction (p= 0.97).

Growth Curve Model Analysis:

Figure 3. The corrected proportion of looking to the target over time.

Note: -2000 to -1500ms is the baseline preference window of analysis, target word happened at 0ms, we analyzed 367ms-2367ms.



Conclusions

- **RQ1:** Toddlers understand both adult and child speech well, with slightly better performance for adult speech.
- **RQ2:** Background noise does not seem to increase task difficulty, but participants increase their target looking more to child speech when in background noise, suggesting that they may be accustomed to processing child speech in these background noise contexts.

Future directions:
- How do toddlers process child-produced speech in other types of noise (e.g., noise not representative of child environment)?
- How do toddlers engage in predictive language processing when hearing speech from adults and children?

Acknowledgements
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Citations:
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3. Cooper, A., Fecher, N., & Johnson, E. K. (2018). Toddlers' comprehension of adult and child talkers: Adult targets versus vocal tract similarity. Cognition, 173, 16-20.
4. Erickson, L. C., & Newman, R. S. (2017). Influences of background noise on infants and children. Current directions in psychological science, 26(5), 451-457.
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